Elementary & Secondary

NASA's ESE elementary and secondary education programs draw on the compelling context of Earth system science to support teacher professional development and promote student achievement in STEM.

Educators challenge their students and motivate them to achieve by enriching their own backgrounds in Earth system science and STEM. Professional development opportunities include online courses, workshops and other activities that support the classroom study of Earth system science.

The ESE Education program strives to inspire the next generation of Earth explorers through hands-on science education experiences that expose K–12 students to Earth system science subjects and processes. The ESE promotes student achievement in STEM by providing unique learning experiences, including opportunities for students to engage in the practices and perspectives of Earth system science, develop new skills, gain experience working with scientists, and develop a deeper understanding of the diversity of Earth system science-related careers.

The ESE Education Program also sponsors the development of education materials in support of STEM curricula. Curricular support efforts focus on an interdisciplinary approach aligned with national education standards in science, geography, mathematics and technology. A listing of specific ESE education products and how to obtain them is included in the "Products and Resources" section of this catalog.

Aeronautics and Earth Science Academy

The mission of the Medgar Evers College (MEC) Aeronautics and Earth Science Academy (AESA) is to provide underrepresented middle and high school students an enriched academic experience that involves various areas of NASA's strategic enterprises, thus encouraging the pursuit of careers in science, technology, engineering and mathematics (STEM).

Through its classes and workshops, AESA aims to: strengthen students' mathematics, science, computer and communication skills; integrate research and related activities into students' academic experiences in order to encourage enrollment in STEM college preparatory courses; give students the confidence and desire to pursue STEM careers; encourage parental involvement and support of students in learning STEM; and increase the number of underrepresented students in the STEM pipeline. Topics covered include air and water pollution, global warming, weather analysis, science on the Internet, careers in science and technology and writing skills development.

The AESA program is held on weekdays after school, Saturdays and during summer vacations. Parents are encouraged to join the "Parent Café" and participate in science and technology conferences held at MEC.

CONTACTS: Leon Johnson, Department of Physical, Environmental and Computer Science, Medgar Evers College of the City University of New York, **Email:** lpjohnson@mec.cuny.edu; William Harris, AEL Project Director, **Email:** wharris@mec.cuny.org.

Alaska Alliance for Earth System Science Education

The Alaska Alliance seeks to increase public understanding of global climate variability and its relevance to Alaskan communities, and to strengthen teaching and learning of related subjects in K–12 and undergraduate classrooms. To accomplish these objectives, the Alliance:

- Adapts existing science and technology content and education materials (e.g., NASA Earth science education resources);

- Improves systemic efforts by linking existing programs with Earth and environmental education institutions; and
- Helps these programs to increase their scope and reach, particularly within rural Alaska.

The Alaska Alliance includes Alaska GLOBE partners and schools, the Alaska Space Grant Program, Kachemak Bay National Estuarine Research Reserve and the Challenger Learning Center of Alaska, and is collaborating closely with the "Observing Locally, Connecting Globally" project.

CONTACT: Elena Sparrow, Research Associate Professor and Alaska GLOBE Coordinator, 317 O'Neill Bldg., University of Alaska Fairbanks, SNRAS, PO Box 757200, Fairbanks, AK 99775-7200, **Phone:** 907-474-7699, **Email:** elena.sparrow@uaf.edu.

Ames Aerospace Encounter

http://encounter.arc.nasa.gov

Created for students in grades 4–6, NASA's Ames Aerospace Encounter is a unique, interactive program designed to stir young people's imaginations and fuel their enthusiasm for science, mathematics and technology. Located in a renovated supersonic wind tunnel, students split their time between four different areas: Space Sciences, Aeronautics, Space Station and Mission Control/Earth Science.

In Space Sciences, students experience some of the basics of physics in fun, physical ways. In Aeronautics, students learn about the principles of flight and wind tunnels and use computers to design airplanes. In Space Station, young people become astronauts on a simulated space station with different experiments to complete. And in Mission Control/Earth Science, children work with a variety of data collected by aircraft and spacecraft to support the space station mission and learn about Earth science.

The Ames Aerospace Encounter is free; groups are accepted on a space-available basis.

CONTACT: Ames Aerospace Encounter, Mail Stop 226-1, NASA Ames Research Center, Moffett Field, CA 94035-1000, **Phone:** 650-604-1110, **Email:** encounter@mail.arc.nasa.gov.

Celebration of Women in Mathematics

http://nia.ecsu.edu/nrts/2002events/102902cwm/cwm.html

The Celebration of Women in Mathematics is a one-day event conducted annually on the campus of Elizabeth City State University in North Carolina. The event brings together more than 400 middle and high school girls and their teachers for a day of mathematics workshops, competitions and career seminars. The objective is to encourage girls to incorporate more mathematics into their studies and to raise the level of mathematics competency in the region of northeastern North Carolina and southeastern Virginia. The celebration is sponsored jointly by the Association for Women in Mathematics and NASA's Minority University–Space Interdisciplinary Network.

CONTACT: Linda Hayden, NASA Network Resources and Training Site, Elizabeth City State University, Box 672, 1704 Weeksville Rd., Elizabeth City, NC 27909, **Phone:** 252-335-3696, **Fax:** 252-335-3790, **Email:** lhayden@umfort.cs.ecsu.edu.

Center for Coastal Zone Assessment and Remote Sensing

Southern University's Center for Coastal Zone Assessment and Remote Sensing (CCZARS) is a NASA University Research Center—a multidisciplinary research unit established at a minority institution to focus on a specific area of NASA interest. The center is supporting the mission of NASA's Stennis Space Center by conducting research in the areas of fisheries habitat assessment, coastal change, land use/land cover change and urban sprawl. CCZARS is also developing related education and outreach initiatives:

- Interdisciplinary faculty research teams will develop course modules and provide technical material.
- A "Distinguished Visiting Researcher" position will be created; incumbent will teach and provide research assistance.
- An undergraduate research program, CCZARS Scholars, will be established, and on-site research experiences for undergraduate and graduate researchers will be provided.
- K–12 students will be introduced to fundamental Earth science concepts and encouraged to pursue careers in science, math, engineering and technology.
- Three-day workshops for current industry partners and K–12 teachers will provide training in geographic information systems (GIS) and remote sensing.
- An annual conference on coastal zone assessment and remote sensing will be held.

CONTACTS: Michael Stubblefield, Director, Southern University and A&M College, PO Box 9764, Baton Rouge, LA 70813, **Phone:** 225-771-4724, Fax: 225-771-4722, **Email:** mastub@bellsouth.net; Deidre Hardy-Street, Program Manager, Southern University and A&M College, PO Box 9764, Baton Rouge, LA 70813, **Phone:** 225-771-4724, **Fax:** 225-771-4722 **Email:** dhardy1@bellsouth.net.

Challenger Center for Space Science Education
http://www.challenger.org

The Challenger Center for Space Science Education is an international nonprofit education organization created in 1986 by the families of the astronauts lost during the Challenger space shuttle mission. Using space exploration as a theme, the center's highly acclaimed programs inspire students to pursue math, science and technology studies, while at the same time helping them develop critical life skills.

The organization launched the Challenger Learning Center Network in 1987. Challenger Learning Centers use technology-rich educational environments to create hands-on learning experiences. They offer a variety of programs, from mission simulations for students to professional development workshops for instructors. Each year, more than 400,000 students visit Challenger Learning Centers across the United States, Canada and the United Kingdom.

The four mission scenarios offered at Challenger Learning Centers—Encounter Earth, Voyage to Mars, Return to the Moon, and Rendezvous with a Comet—allow students to rev up their imaginations and transform themselves into astronauts, scientists and engineers. All of the scenarios meet or exceed national science education standards, and were developed with NASA engineers and scientists to ensure an authentic experience. Mission scenarios and fees vary by location. Log on to the Web site to find the Challenger Learning Center nearest you.

CONTACT: Challenger Center for Space Science Education, 1250 North Pitt St., Alexandria, VA 22314, **Phone:** 703-683-9740, **Fax:** 703-683-7546.

Challenger's e-Mission: Operation Montserrat
http://clc.wju.edu/om

On September 4, 1996, the island of Montserrat was the world's most dangerous place. Two potentially catastrophic events converged simultaneously upon this Caribbean paradise—an awakening volcano and a Category 3 hurricane.

Using the Internet, students in grades 5–10 connect to the Challenger Learning Center's Mission Control at Wheeling Jesuit University for a unique, interactive learning adventure. After completing an online application and resume, students form emergency response teams and prepare for their mission by collecting and analyzing relevant Earth science data.

On mission day, students join one of four crisis management teams—the Volcano Team, Hurricane Team, Evacuation Team or Communication Team—and use science knowledge and math skills to avert possible disaster. In a two-hour period, the Volcano and Hurricane teams rally to analyze real-time data and determine the risks to the people on the island. The analyses are then presented to the Evacuation Team to determine the rescue plan. Throughout the mission, the Communication Team is in live contact with Mission Control via video, audio and a "chat window."

For teachers, the mission and the pre-mission curriculum are a new way to introduce various science and math topics. Resources for teachers include training workshops, lesson plans, assessment materials and online support. The mission package also includes technology support to help teachers prepare their classrooms for mission day.

CONTACT: Jackie Shia, e-Mission Development Center, Challenger Learning Center at Wheeling Jesuit University, 316 Washington Ave., Wheeling, WV 26003, **Phone:** 304-243-4431, **Email:** jshia@cet.edu.

Operation Montserrat is also offered by the following Challenger Learning Centers:

- Challenger Learning Center of Alaska: *http://akchallenger.org*
- Challenger Learning Center of Arizona: *http://www.azchallenger.org*
- Honeywell Challenger Learning Center at California State University, Dominguez Hills: *http://www.csudh.edu/clc*
- Challenger Learning Center at Chabot Space & Science Center: *http://www.chabotspace.org*
- Challenger Learning Center of Colorado Springs: *http://www.clccs.org*
- Challenger Learning Center of Northwest Indiana: *http://www.clcnwi.com*
- Challenger Learning Center at Paducah: *http://www.clcpaducah.org*
- Challenger Learning Centre, National Space Centre, Leicester, United Kingdom: *http://www.spacecentre.co.uk*

The Chesapeake Bay Watershed Initiative
http://www.cbwi.org

The Chesapeake Bay Watershed Initiative (CBWI) is a hydrology-based scientific experiment being conducted by K–12 students in the mid-Atlantic region. Students are working to determine if possible causes and effects of changes in nutrient levels in tributaries of the bay can be correlated with changes in land cover, land use or weather phenomena, as observed from the ground and from space. The experiment is a team project requiring students with

varying levels of expertise to conduct in situ measurements of water quality, compile weather information and analyze Landsat satellite imagery to investigate spatial and temporal changes in land use and land cover. While students are held accountable for the accuracy of their work, they are not graded on their participation.

The CBWI has immediate relevance to the Chesapeake Bay, but the experiment could be adopted and adapted for use by students and educators in other parts of the nation as well.

The project was organized and implemented in early 1998 by state Space Grant consortia in Delaware, Maryland, Pennsylvania, Virginia, West Virginia and the District of Columbia. These consortia are all members of NASA's National Space Grant College and Fellowship Program. The Maryland Space Grant Consortium was selected to organize and manage the CBWI on behalf of the other state consortia.

CONTACT: Robert Popham, **Email:** rwpopham@prodigy.net.

DEVELOP

http://develop.larc.nasa.gov

DEVELOP is an initiative that extends NASA Earth science research to local communities. Student teams demonstrate to community leaders prototype applications of NASA Earth science measurements and predictions addressing local policy issues. The program is a year-round activity, with teams located nationwide. High school through graduate students with strong interests in science, technology and policy are encouraged to apply.

DEVELOP students initiate and research projects in response to challenges that communities pose at leadership forums, such as governors' conferences and association meetings. Their final research results are presented as computer-generated visualizations. The activity is student-led, with NASA scientists serving as advisors. The student projects use NASA Earth science mission data and models, and cover all 12 NASA applications of national priority: agricultural efficiency, air quality, aviation safety, carbon management, coastal management, disaster management, ecological forecasting, energy management, homeland security, invasive species, public health and water management.

Each project requires partnerships with the target community to achieve the greatest return on investment. Students work with industry, nonprofit organizations or local governments to attract long-term technology and education benefits to the community.

In addition to the core Earth science applications projects, students also conduct outreach activities. For the purposes of advanced visualization demonstrations, students constructed a portable visual immersion environment. DEVELOP also supports the federal Computers for Learning Program by establishing Earth science education computer labs in schools nationwide.

CONTACTS: DEVELOP National Program Office, MS 307, NASA Langley Research Center, Hampton, VA 23681-2199, **Phone:** 757-864-3761; **Fax:** 757-864-7890, **Email:** michael.l.ruiz@nasa.gov; DEVELOP Western Regional Office, MS 239-20, NASA Ames Research Center, Moffett Field, CA 94035-1000, **Phone:** 650-604-3614; **Fax:** 650-604-1088, **Email:** joseph.w.skiles@nasa.gov.

The Dynamic Earth

http://www.discoverycube.org

Located in Santa Ana, California, Discovery Science Center is a nonprofit organization dedicated to educating young minds, assisting teachers and increasing public understanding of science, math and technology through interactive exhibits and programs. The center's Dynamic Earth program includes:

- A curriculum packet containing lesson plans on several topics, such as earthquakes, atmospheric sciences and water quality monitoring;
- A program for training teachers in the use of the lesson plans—the six-hour training covers 2–3 weeks of classroom instruction; and
- An interactive science presentation featuring hands-on exhibits, including an earthquake simulation room, an eight-foot freestanding tornado, and a kalliroscope that models the fluid dynamics of the ocean and atmosphere.

Participants in Dynamic Earth investigate various topics, including plate tectonics and the changing patterns of land, sea and mountains on the Earth's surface; how the Sun's heating of the Earth's surface drives atmospheric and oceanic circulations, global weather patterns and geographical distribution of marine and terrestrial organisms; and how human impacts on the Earth's atmosphere and waterways affect all life on Earth.

CONTACT: Janet Yamaguchi, Vice President, Education, Discovery Science Center, 2500 North Main St., Santa Ana, CA 92705, **Phone:** 714-542-2823, **Fax:** 714-542-2828, **Email:** jyamaguchi@discoverycube.org.

Earth Observatory

http://earthobservatory.nasa.gov

NASA's Earth Observatory is an interactive Web-based magazine where the science-attentive public can obtain new satellite imagery and scientific information about our home planet. The focus is on Earth's climate and environmental change. The site is also designed to be useful to public media and educators. Any and all materials published on the Earth Observatory are freely available for re-publication, re-use or re-broadcast (except in rare cases where copyright is indicated).

Visit the Earth Observatory to read feature articles on wide-ranging Earth system science topics, download datasets and images for analysis, read breaking news, learn about current and planned Earth missions, search an online library for reference materials, track natural hazards around the world in near real time, and access interactive experiments and classroom activities.

CONTACT: David Herring, Code 913, NASA Goddard Space Flight Center, Greenbelt, MD 20771, **Phone:** 301-614-6219, **Email:** dherring@climate.gsfc.nasa.gov.

Earth Observing System (EOS) Education Project

http://www.eoscenter.com

The University of Montana's EOS Education Project disseminates Earth imagery, develops interdisciplinary programs and provides opportunities for teachers and students to learn about the interpretation, use and relevance of geospatial and technology-related information. Its primary focus is to serve the needs of the international preK–16 educational community.

In order to achieve its objectives, the EOS Education Project:

- Uses emerging technologies such as map, image and document services to deliver geospatial and multimedia information directly into the classroom;
- Provides teacher development programs in the form of on-site and Internet-based classes in relevant technologies, such as geographic information systems (GIS), at little or no cost to the educational community;
- Develops outreach programs combining teacher in-service and pre-service workshops in various curricula and emerging technologies;
- Provides thematic education programs and materials, such as the EOS Newsletter, to increase public awareness about NASA's Earth science educational resources; and
- Makes resources available to create, develop and share materials through a computer-based communications system capable of providing easy access to information and curricula (it is hoped that this technology can be used to assist schools funded by the Bureau of Indian Affairs).

CONTACT: Jeff Crews, Assistant Director, NASA EOS Education Project, James E. Todd Building, University of Montana, Missoula, MT 59812, **Phone:** 406-243-2644, **Fax:** 406-243-2047, **Email:** jcrews@eoscenter.com.

Earth Science Component for Academic Professional Enhancement (ESCAPE)

http://tellus.ssec.wisc.edu/outreach/ESCAPE/esc.htm

This course addresses the professional development needs of upper elementary, middle and high school science teachers in Wisconsin and neighboring states by offering an online Earth system science course in conjunction with the GETWISE project. ESCAPE investigates deforestation, volcanoes, hurricanes and ice shelf disintegration. GETWISE currently features two lecture series, one in Earth system science and another focusing on the solar system.

Two graduate credits are available through the University of Wisconsin-Madison's Department of Atmospheric and Oceanic Sciences upon successful completion of the ESCAPE course.

CONTACT: Margaret Mooney, Office of Space Science Education-Space Science & Engineering Center, University of Wisconsin-Madison, 1225 W. Dayton St., Madison, WI 53706, **Email:** mooney@ssec.wisc.edu.

Earth Science Professional Development Workshops at NASA/JPL Educator Resource Center

http://education.jpl.nasa.gov/resources/workshops.html

Starting in spring 2004, NASA's Jet Propulsion Laboratory (JPL) will be hosting Earth science workshops on a regular basis through the NASA/JPL Educator Resource Center in Pomona, California. NASA education specialists will conduct the workshops, which are geared toward in-service and pre-service K–12 educators and will cover a variety of topics, including NASA's unique missions and results. The workshops will provide and utilize NASA curriculum support products, are based on national standards and can be aligned with state standards. Credit is available.

CONTACT: Paula Padilla, Educator Resource Center Coordinator, Jet Propulsion Laboratory, 4800 Oak Grove Dr., MS 180-109, Pasadena, CA 91108, **Phone:** 909-397-4420, **Email:** paula.padilla@jpl.nasa.gov.

Earth System Science Academy

http://nia.ecsu.edu/nrts/nrtsmisc/essa.html

The Earth System Science Academy is one of the major K–12 Earth system science initiatives sponsored by Elizabeth City State University's Network Resources and Training Site, which is funded by NASA's Minority University-Space Interdisciplinary Network. During the two-day summer academy, teachers tour the Great Dismal Swamp and become actively involved with water testing techniques. Teachers attend both geoscience and Internet workshops. Internet workshops focus on NASA Earth system science educational resources. The Academy offers educators the opportunity to learn about the health of local waterways and the Great Dismal Swamp, and challenges educators to develop new skills through the experience of working with university and NASA researchers.

Included in the Academy is a tour of the Great Dismal Swamp Boardwalk, hands-on water quality labs and workshops on Earth system science.

CONTACT: Linda Hayden, NASA Network Resources and Training Site, Elizabeth City State University, Box 672, 1704 Weeksville Rd., Elizabeth City, NC 27909, **Phone:** 252-335-3696, **Fax:** 252-335-3790, **Email:** lhayden@umfort.cs.ecsu.edu.

Earth System Science Education Alliance (ESSEA)

http://www.cet.edu/essea

Sponsored by NASA's ESE, ESSEA is an exciting and innovative professional development program for K–12 teachers. Participating universities, colleges and science education organizations are offering Earth system science online graduate courses to in-service and pre-service educators. The courses use an innovative instructional design model, are delivered over the Internet and feature student-centered, knowledge-building virtual communities. A master teacher and/or Earth system scientist moderate participants, acting as guides and mentors throughout the 16-week courses.

The three courses can be viewed at the following sites:

- Elementary School Teachers' Earth System Science Course: *http://www2.cet.edu/ete/hilk4/main.html*
- Middle School Teachers' Earth System Science Course: *http://www2.cet.edu/ete/5-8/main.html*
- High School Teachers' Earth System Science Course: *http://www2.cet.edu/ete/hil912/main.html*

The courses were developed within the Center for Educational Technologies (CET) at Wheeling Jesuit University. ESSEA is a partnership between CET and the Institute for Global Environmental Strategies, with the participation of 18 colleges and universities.

CONTACT: A listing of ESSEA participating universities and contact information, courses and schedules is available at *http://www.cet.edu/essea* (click on the link for "Course Offerings"). Course costs will vary by university. For general program information, contact: Claudia Dauksys, **Phone:** 703-312-0827, **Email:** essea@strategies.org.

Earthworks: Earth System Science for Secondary Teachers

http://cires.colorado.edu/~k12/earthworks

Run by the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado at Boulder, Earthworks is a free one-week workshop in the Rocky Mountains designed to help secondary teachers create Earth system science research projects for their students. The workshop is geared toward new in-service teachers and is also suitable for experienced teachers who want to learn more about Earth system science. No previous knowledge of Earth science is required.

The 2004 Earthworks will be held June 19–25 at the Cal-Wood Conservation Education Resource Center, approximately 15 miles northwest of Boulder, Colorado. Travel, lodging, meals and curriculum materials are provided at no charge. Participants can choose from dormitory-style cabin accommodations or outdoor campsites. University credit is available at cost.

Teachers will work in small groups with scientists in designing and conducting research projects and investigating Earth system science at the local level—through the interconnections between the geosphere, atmosphere, biosphere and hydrosphere. Through fieldwork, observations and small-group discussions, a variety of teaching and learning techniques will be practiced.

CONTACT: Genny Healy, CIRES, EARTHWORKS, UCB 216, University of Colorado, Boulder, CO 80309, **Phone:** 303-735-3641, **Email:** ghealy@cires.colorado.edu.

Extending NASA Earth Science Data Use to the K–12 and Citizen Scientist Communities

http://mynasadata.larc.nasa.gov

This project will make NASA Earth science data sets accessible to the K–12 community by extracting parameters of interest and making data available in a format that can be easily downloaded and explored. The focus will first be on atmospheric science data currently held at the NASA

Langley Atmospheric Sciences Data Center. Suggestions from teachers to help guide the selection and development of useful data sets are welcome.

The project will also involve open-source development of tools for data manipulation and access, and the development of a network of citizen scientists who are willing to assist teachers in their community with the use of these data. Teacher workshops are also planned to help teachers get started with use of these data and to provide feedback on ease of use and areas of improvement.

CONTACT: Lin Chambers, Atmospheric Sciences, NASA Langley Research Center, MS 420, Hampton, VA 23681-2199, **Phone:** 757-864-4371, **Fax:** 757-864-7996, **Email:** Lin.H.Chambers@larc.nasa.gov.

Federation of Earth Science Information Partners

http://www.esipfed.org

The Federation of Earth Science Information Partners (ESIP) brings together government agencies, universities, nonprofit organizations and businesses in an effort to make Earth science information available to a broader community. NASA is a sponsoring agency of the ESIP Federation.

The objective of the Federation is to evolve methods that make Earth science data (satellite and ground-based) easy to preserve, locate, access and use for all beneficial applications, including research, education, commercial development, agriculture, land management, environmental monitoring, policy making and many other applications.

Visit the Federation Web site to learn about ESIP education services and products for elementary through college levels, informal education and professional development.

CONTACT: Dave Jones, President of the ESIP Federation, Columbia Corporate Park 100, 6021 University Blvd., Suite 140, Ellicott City, MD 21043, **Phone:** 410-203-1316, **Fax:** 410-203-9341, **Email:** dave@stormcenter.com.

Forest Watch

http://www.forestwatch.sr.unh.edu

Forest Watch is an environmental education program developed and run by the Complex Systems Research Center at the University of New Hampshire (UNH). The program is designed to introduce both teachers and their students to field, laboratory and satellite data analysis methods for assessing the health of local forest stands. Forest Watch conducts workshops that help K–12 teachers introduce their students to hands-on techniques for evaluating the health of white pine (Pinus strobus), a bio-indicator for tropospheric ozone damage. Through Forest Watch, students become actively involved in meaningful scientific research, as students and teachers set up permanent sampling plots in a forest stand and conduct several ecological and biophysical measurements using scientific protocols. The data students collect is a valuable resource for UNH researchers.

Forest Watch has two main objectives: 1) to introduce teachers to techniques that allow students to assess environmental conditions of forest stands and tree species over time; and 2) to provide data to research scientists in order to assess the regional impacts of air pollution on forested species. In conducting ecological site assessments, students are introduced to several science disciplines, including botany, biology, chemistry and physics, as well as some non-scientific disciplines. Professional development workshops are offered to teachers around the New England region.

CONTACTS: Barry Rock, Program Director, or Mike Gagnon, Program Coordinator, Complex Systems Research Center, Morse Hall, University of New Hampshire, Durham, NH 03824, **Phone:** 603-862-1792, **Fax:** 603-862-0188, **Email:** forestwatch@unh.edu.

The GAIA Crossroads Project

http://www.bigelow.org/~gaia

The Gaia Crossroads Project is a K–12 education project that explores the value of remotely sensed data as a resource for learning. Since its inception in June 1990, this program has been implemented at all grade levels in more than 94 schools throughout Maine and New Hampshire. Using the imagery provided, students are able to study and interpret satellite images of their local communities. After an initial focus on the local environment, the program expands to include images with broader geographic coverage—including images of the Gulf of Maine and the North Atlantic for studying oceanography, weather satellite images for studying meteorology and images of tropical rain forests for studying global ecosystems. The project provides ongoing teacher training and technical support.

The Gaia Crossroads Project: Guidebook to Using Satellite Imagery in the Classroom and Community contains background information on the project, a remote-sensing primer, hands-on tutorials, ideas for setting up the program in a classroom, more than 60 activities written and tested by teachers and an extensive listing of resources.

CONTACT: Cyndy Erickson, Project Director, **Email:** gaiaxroads@bigelow.org or: gaiaxroads@earthlink.net.

The GLOBE Program

http://www.globe.gov

GLOBE is a worldwide network of K–12 students who, under the guidance of trained teachers, make a core set of environmental observations and report their data via the Internet. NASA scientists use GLOBE data in their research and provide feedback to the students. Maps and graphs based on GLOBE student data can be created on the program's Web site, providing "real-life" information for student inquiry. The idea that Earth is a system of interconnected parts is at the root of the program. Observations and measurements cover the following areas: Atmosphere/Climate, Hydrology, Land Cover/Biology, Soils and Phenology.

There is no cost to participate in the program in the United States. GLOBE supplies educational materials and an interactive Web site; and educational institutions, including colleges and universities, partner with GLOBE to train teachers in protocols for collecting data. To participate, a school must have one or more teachers attend a training workshop, make equipment available to students for taking measurements and provide Internet access for the reporting of data. Nobel Laureate Dr. Leon Lederman says, "GLOBE is the quintessentially ideal program for involving kids in science."

Teachers and students from more than 14,000 schools in over 100 countries currently participate in GLOBE. In the United States, GLOBE is managed by the University Corporation for Atmospheric Research and Colorado State University, under sponsorship of NASA, the National Science Foundation and the U.S. Department of State. Other nations administer their own programs.

CONTACT: Phone: 1-800-858-9947, **Email:** help@globe.gov.

ISS EarthKAM

http://www.earthkam.ucsd.edu

ISS EarthKAM is a NASA education program that enables students, teachers and the public to learn about Earth from the unique perspective of space. At the core of the program is a spectacular collection of digital images of Earth. The image collection and accompanying learning guides and activities are extraordinary resources to support classes in Earth science, space science, geography, social studies, mathematics, communications and art.

ISS EarthKAM images are unique because they are taken by middle school students. Using the program's Web site, students request images based upon their classroom investigations. Since the program's inception in 1996, the ISS EarthKAM camera has flown on five Space Shuttle flights and taken almost 5000 images. Currently, the camera resides on the International Space Station (ISS).

Middle school educators who would like to have their students take photographs with the ISS EarthKAM can quickly and easily register for the program online. Everyone is invited to use and enjoy the photos and educational support materials. ISS EarthKAM is a collaboration among NASA; the University of California, San Diego; Texas A&M; and TERC's Center for Earth and Space Science Education.

CONTACT: Karen Flammer, UCSD EarthKAM, Mail Code 0426, Serf Room 308, 9500 Gilman Dr., La Jolla, CA 92093-0426, **Phone:** 858-534-5827, **Fax:** 858-822-1277, **Email:** ek-help@earthkam.ucsd.edu.

The JASON Project

http://www.jason.org

Geared toward grades 4–9, the JASON Project provides experience-based science and math curriculum and professional development. Using multimedia tools and access to the nation's leading scientists, JASON combines genuine scientific expeditions around the world, standards-based classroom curriculum and accredited professional learning for teachers—to deliver real-life adventures in learning and measurable gains in student achievement.

JASON goes from the depths of the ocean to the heights of rainforest canopies and from icy polar regions to red-hot volcanoes, to take students and teachers on an exciting journey that sparks imagination and enhances the classroom experience. JASON's supplementary science curriculum connects students and teachers with researchers in the field and is designed by the world's leading scientists and educators. Teachers are able to integrate JASON's easy-to-use, technology-rich content in ways that work for today's standards-based education environment. Correlated to textbooks, the instructional design incorporates hands-on and inquiry-based learning. JASON is based on national standards for science, math, social studies, language arts and technology and aligned with state standards for science.

JASON supplies everything a classroom needs to create an exciting, experience-based learning adventure:

- Complete curriculum set, including lessons, activities, experiments and teacher's guide;
- Preview videotape with expert scientists;
- Online materials, student activities, math tools and support resources;
- Classroom resources, including reading list and classroom maps;
- Self-assessment exercises allowing students to measure their own performance; and
- Live broadcast of two-week expedition.

JASON is also a leader in innovative professional learning solutions for math and science educators, providing simple and affordable options—all designed to improve instructional strategies. JASON offers online academy courses, face-to-face workshops, on-site modeling and coaching institutes and an annual educators' conference. JASON sites are located throughout the country, including at NASA's Ames Research Center, Goddard Space Flight Center and Johnson Space Center. Programs focus on rainforests, oceans, extreme environments, volcanoes and exploration of inner and outer space.

CONTACT: Phone: 1-888-527-6600, **Email:** info@jason.org.

Johns Hopkins Earth/Space Science Graduate Studies Program

http://www.mdspacegrant.org/ssip_about.html

The Maryland Space Grant Consortium, in collaboration with the Johns Hopkins University Graduate Division of Education, offers graduate course work in Earth/space science that may be used toward a "Graduate Certificate in Earth/Space Science" or a "Master of Science in Education: Educational Studies with Concentration in Earth/Space Science" from Johns Hopkins University.

Open to elementary, middle and high school teachers in mathematics, science, physics, environmental science, social studies or geography, the program fosters collaboration among Johns Hopkins, NASA's Goddard Space Flight Center, the Maryland State Department of Education and affiliates of the Maryland Space Grant Consortium. See Web site for complete information, including course requirements and financial assistance.

CONTACT: Anne Anikis, Assistant Director, Maryland Space Grant Consortium, The Johns Hopkins University, 203 Bloomberg Center for Physics and Astronomy, 3400 N. Charles St., Baltimore, MD 21218-2686, *Phone:* 410-516-7106, *Fax:* 410-516-4109, *Email:* anne@pha.jhu.edu.

Learning Technologies Project (LTP)

http://education.nasa.gov/ltp

The Learning Technologies Project (LTP) is NASA's educational technology incubator. This effort funds and collaborates with activities that join NASA content with emerging technologies and innovative use of entrenched technologies—to inspire students to pursue careers in science, math, engineering and technology. LTP nurtures and partners with the entrepreneurial talents of government, industry, academia, nonprofits and NASA enterprises to develop educational technology that enables learners of diverse backgrounds, characteristics and abilities. LTP supports the widest possible dissemination of educational technology that engages the learner in compelling scientific and mathematical concepts using NASA data.

Periodically, LTP solicits and awards several grants and cooperative agreements to organizations outside of NASA through the LEARNERS (Leading Educators to Applications, Research and NASA-related Educational Resources in Science) project.

CONTACTS: Patrick Hogan, LTP Deputy, NASA Ames Research Center, **Phone:** 650-604-5656, **Email:** Patrick.Hogan@nasa.gov; Susan Hoban, Learners Project Coordinator, NASA Goddard Space Flight Center, **Phone:** 301-286-7980, **Email:** susan.hoban@gsfc.nasa.gov

Mathematics of the Great Dismal Swamp Project

http://nia.ecsu.edu/nrts/ess/mds/mds.html

The Mathematics of the Great Dismal Swamp Project supports a team of professors from Elizabeth City State University, using research on the Great Dismal Swamp as a platform for development of mathematics education lessons that incorporate a generic wetlands application. Four new modules will be developed, all of which include an interdisciplinary approach for incorporating Earth system science into K–12 courses. Lessons will be produced on lithographs, postcards, CD-ROMs and posters.

CONTACT: Linda Hayden, NASA Network Resources and Training Site, Elizabeth City State University, Box 672, 1704 Weeksville Rd., Elizabeth City, NC 27909, **Phone:** 252-335-3696, *Fax:* 252-335-3790, **Email:** lhayden@umfort.cs.ecsu.edu.

Measuring Vegetation Health

The health of a plant can be readily determined by measuring the relative intensity of visible and infrared light reflected from its leaves and by studying changes in plant growth. This project will use a series of six technologies to measure the intensities of reflected light and the growing patterns of plants: light-emitting diode (LED) connected to a voltmeter; ALTA II reflectance spectrometer; a digital camera with filters; a camera flown on a kite or weather balloon; a hyperspectral camera flown on airplanes; and the remote-sensing software, MultiSpec.

The sequential use of these technologies is designed to focus on the local environment, first at very small scales, then with increasing spatial coverage. Through the use of these technologies, middle and high school students become familiar with the principles of light, reflection,

transmission, color, plants, photosynthesis and remote-sensing measurements, as well as with the local surface cover in the imagery. Students also learn about the strengths and limitations of individual measurement technologies and realize the need for integrating multiple perspectives into scientific studies.

The "Measuring Vegetation Health" series will be integrated into both the Global Systems Science curriculum *(http://www.lawrenceballofscience.org/gss),* created by the Lawrence Hall of Science at the University of California, Berkeley, and into the activities of the University of New Hampshire's Forest Watch program *(http://www.forestwatch.sr.unh.edu)*. The integrated series will be available as a stand-alone unit that may be incorporated by teachers when needed, as a yearlong curriculum or as activities for use by museums, science centers, arboretums and botanical gardens.

CONTACT: John Pickle, Program Manager for Global Systems Science, Museum of Science, Science Park, Boston, MA 02114-1099, **Phone:** 617-589-0436, **Fax:** 617-589-0389, **Email:** jpickle@mos.org.

Minority University-SPace Interdisciplinary Network (MU-SPIN)

http://muspin.gsfc.nasa.gov

NASA created MU-SPIN to help train the next generation of NASA's minority scientists and engineers. The program has remained a highly effective tool throughout its growth and evolution over the past decade. MU-SPIN serves America's Historically Black Colleges and Universities (HBCUs) and Other Minority Universities (OMUs), which include Hispanic Serving Institutes (HSIs) and Tribal Colleges and Universities (TCUs).

The first step for the MU-SPIN program was to provide network infrastructure by helping minority schools to purchase, and even build, computers for the classroom. During its next phase, MU-SPIN established Network Resources and Training Sites (NRTSs), allowing the program to expand and target a larger minority community of students, faculty, administrators and community members. Next, MU-SPIN established Expert Institutes to help foster scientific curriculum development and research with the goal of increasing participation in NASA-related science, especially Earth science. MU-SPIN also created the Institutes for Collaborative Research and Education (ICRE) model to further promote NASA science and technology in minority schools.

CONTACT: James Harrington, MU-SPIN Project Manager, Code 933, NASA Goddard Space Flight Center, Greenbelt, MD 20771, **Phone:** 301-286-4063, **Fax:** 301-286-1775, **Email:** james@muspin.gsfc.nasa.gov.

NASA Earth Science Missions—Education Programs and Resources

Many of NASA's Earth science missions have an education and/or public outreach component. These efforts include a wide variety of activities and resources for educators, students and the public, including teacher workshops, public programs and events and curriculum and classroom materials in the form of CD-ROMs, posters, brochures and videos. Visit the Web sites listed with each mission for specific information on a mission's programs and resources, including access to satellite imagery and other data. Missions are listed by year of launch or scheduled launch.

TOPEX/Poseidon

http://sealevel.jpl.nasa.gov/education/education.html

Jointly sponsored by NASA and CNES, the French space agency, the TOPEX/Poseidon satellite uses radar altimeters to continuously survey ocean surface height. The Jason-1 satellite joined TOPEX/Poseidon in orbit in 2001 to collect similar data.

Scientists are using TOPEX/Poseidon and Jason-1 data to learn more about global ocean circulation patterns, including phenomena such as El Niño/La Niña. Oceans are a key mechanism in transporting heat from the Sun around the globe. Researchers are working to improve understanding of the role oceans play in controlling seasonal variations and longer-term climate changes. Ocean altimetry data are also used for operational purposes, including ship routing, fisheries management, hurricane forecasting and support of underwater activities like cable laying.

CONTACTS: Annie Richardson or Mona Jasnow, Jet Propulsion Laboratory, **Email:** topex@jpl.nasa.gov. (Launched: 1992)

SeaWiFS

http://seawifs.gsfc.nasa.gov/SEAWIFS/TEACHERS

The Sea-viewing Wide Field-of-view Sensor (SeaWiFS) is providing quantitative data on global ocean bio-optical properties. Subtle changes in ocean color signify various types and quantities of marine phytoplankton (microscopic marine plants), the knowledge of which has both scientific and practical applications. SeaWiFS has helped us to not only monitor the short-term spatial and temporal variability in the ocean's biology, but also to have the first well-calibrated, long-term data set that allows us to quantify the ocean's biological response to global change. (Launched: 1997)

Tropical Rainfall Measuring Mission (TRMM)

http://trmm.gsfc.nasa.gov
http://strategies.org/TRMM.html

TRMM is a joint mission between NASA and the National Space Development Agency of Japan (NASDA). It was designed to monitor and study tropical rainfall and the associated release of energy that helps to power the global atmospheric circulations shaping both weather and climate around the world.

CONTACT: Jeffrey Halverson, TRMM Education and Outreach Scientist, Code 912, NASA Goddard Space Flight Center, Greenbelt, MD 20771, **Phone:** 301-614-6333, **Email:** halverson@agnes.gsfc.nasa.gov. (Launched: 1997)

ACRIMSAT

http://acrim.jpl.nasa.gov/education/eduindex.html

Using the Active Cavity Radiometer Irradiance Monitor (ACRIM) III instrument, the ACRIMSAT spacecraft provides long-term, precise measurements of the total amount of the Sun's energy that falls on our planet's surface, oceans and atmosphere. ACRIM I was the first instrument to clearly show that the energy from the Sun is not a constant value but instead varies over time. These energy changes are small but significant, and they cycle approximately every 11 years. ACRIMSAT data is vital to helping scientists build more accurate climate models. (Launched: 1999)

Landsat 7

http://landsat.gsfc.nasa.gov/main/education.html

The Landsat 7 satellite is acquiring remotely sensed images of land surface and coastal regions for global change research, regional environmental change studies, national security uses and other civil and commercial purposes. The Landsat 7 data set will provide the first high-resolution view of both seasonal and interannual changes in the terrestrial environment.

CONTACT: Stephanie Stockman, Code 921, NASA Goddard Space Flight Center, **Phone:** 301-614-6457, **Email:** stockman@core2.gsfc.nasa.gov. (Launched: 1999)

SeaWinds on QuikSCAT

http://winds.jpl.nasa.gov/education

The SeaWinds instrument on the QuikSCAT satellite is a "quick recovery" effort to fill the gap created by the loss of data from the NASA Scatterometer (NSCAT) when the satellite lost power in June of 1997. SeaWinds is a specialized microwave radar that measures near-surface wind speed and direction over the Earth's oceans under all weather and cloud conditions.

CONTACT: Peter Falcon, Scatterometer Projects Outreach Coordinator, Jet Propulsion Laboratory, 4800 Oak Grove Dr., MS TR 1722-114, Pasadena, CA 91109-8099, **Phone:** 818-393-0729, *Fax:* 818-354-8813, **Email:** pcfalcon@pop.jpl.nasa.gov. (Launched: 1999)

Terra

http://terra.nasa.gov

Terra, the flagship satellite of NASA's Earth Observing System, is collecting what will ultimately become a new, 15-year global data set on the state of the land, oceans and atmosphere. Data from this mission are used in many research and commercial applications.

CONTACT: David Herring, Code 913, NASA Goddard Space Flight Center, Greenbelt, MD 20771, **Phone:** 301-614-6219, **Email:** dherring@climate.gsfc.nasa.gov. (Launched: 1999)

EO-1

http://eo1.gsfc.nasa.gov/Education/eo1Education.html

Earth Observing-1 (EO-1) is the first flight of NASA's New Millennium Program (NMP). Its mission is to validate technologies that will reduce the cost and increase the capabilities of upcoming land-imaging missions. As a result of EO-1, future spacecraft will be an order of magnitude smaller and lighter than current versions.

CONTACT: Joseph Young, EO-1 Mission Technology Transfer Manager, NASA Goddard Space Flight Center, **Phone:** 301-286-8146, **Email:** joseph.p.young.1@gsfc.nasa.gov. (Launched: 2000)

Jason-1

http://sealevel.jpl.nasa.gov/education/education.html

Jointly sponsored by NASA and CNES, the French space agency, Jason-1 is a follow-on mission to TOPEX/Poseidon. See TOPEX/Poseidon listing (p. 10) for additional details. (Launched: 2001)

SAGE III/METEOR-3M

http://www-sage3.larc.nasa.gov/solar

The Stratospheric Aerosol and Gas Experiment (SAGE) III mission on the Russian Meteor-3M spacecraft seeks to enhance our understanding of natural and human-derived atmospheric processes—by providing high-latitude, long-term measurements of the vertical structure of aerosols, ozone, water vapor and other important trace gases in the upper troposphere and stratosphere. Student's On-Line Atmospheric Research (SOLAR) is the education and outreach component of SAGE III.

CONTACT: David Woods, NASA Langley Research Center, Hampton, VA 23681, **Email:** d.c.woods@larc.nasa.gov. (Launched: 2001)

Aqua

http://aqua.nasa.gov

Latin for "water," Aqua is named for the large amount of information the mission is collecting about the Earth's water cycle, including evaporation from the oceans, water vapor in the atmosphere, clouds, precipitation, soil moisture, sea ice, land ice and snow cover on land and ice. Additional variables also being measured by Aqua include radiative energy fluxes, aerosols, vegetation cover on land, phytoplankton and dissolved organic matter in the oceans and air, land and water temperatures.

CONTACTS: Claire Parkinson, Code 971, NASA Goddard Space Flight Center, Greenbelt, MD 20771, **Phone:** 301-614-5715, **Email:** claire.l.parkinson@nasa.gov; Steve Graham, Code 900, NASA Goddard Space Flight Center, **Phone:** 301-614-5561, **Email:** steven.m.graham.2@gsfc.nasa.gov. (Launched: 2002)

GRACE

http://www.csr.utexas.edu/grace/education

The second of the Pathfinder missions, the Gravity Recovery and Climate Experiment (GRACE) employs a satellite-to-satellite microwave tracking system to measure the Earth's gravity field and its variability over time. Such measurements are directly coupled to long-wavelength ocean circulation processes and to the transport of ocean heat to the Earth's poles.

CONTACT: Email: grace_edu@tsgc.utexas.edu. (Launched: 2002)

SeaWinds on ADEOS II

http://winds.jpl.nasa.gov/education

The Advanced Earth Observing Satellite (ADEOS) II is a joint mission with the National Space Development Agency of Japan (NASDA). The SeaWinds scatterometer is a specialized microwave radar that measures near-surface wind velocity (both speed and direction) over the Earth's oceans under all weather and cloud conditions.

CONTACT: Peter Falcon, Scatterometer Projects Outreach Coordinator, Jet Propulsion Laboratory, 4800 Oak Grove Dr., MS TR 1722-114, Pasadena, CA 91109-8099, **Phone:** 818-393-0729, **Fax:** 818-354-8813, **Email:** pcfalcon@pop.jpl.nasa.gov. (Launched: 2002)

ICESat

http://icesat.gsfc.nasa.gov/publicoutreach.html

The Ice, Cloud and Land Elevation Satellite (ICESat) operates the Geoscience Laser Altimeter System (GLAS), which accurately measures the elevation of the Earth's ice sheets, clouds and land. Data is available from the National Snow and Ice Data Center: *http://nsidc.org/daac/icesat.*

CONTACT: Email: webmaster@icesat0.gsfc.nasa.gov. (Launched: 2003)

SORCE

http://lasp.colorado.edu/sorce/edu_outreach.html

The Solar Radiation and Climate Experiment (SORCE) mission is providing state-of-the-art measurements of incoming x-ray, ultraviolet, visible, near-infrared and total solar radiation. The measurements provided by SORCE specifically address long-term climate change, natural variability and enhanced climate prediction, as well as atmospheric ozone and UV-B radiation. These measurements are critical to studies of the Sun and its effect on the Earth system.

CONTACT: Gary Rottman, Laboratory for Atmospheric and Space Physics, Campus Box 590, University of Colorado, Boulder, CO 80309-0590, **Phone:** 303-492-8324, **Email:** gary.rottman@lasp.colorado.edu. (Launched: 2003)

Aura

http://aura.gsfc.nasa.gov/outreach

Aura will study the Earth's ozone, air quality and climate. The mission is designed exclusively to conduct research on the composition, chemistry and dynamics of the Earth's upper and lower atmosphere.

CONTACT: Stephanie Stockman, Code 921, NASA Goddard Space Flight Center, **Email:** stockman@core2.gsfc.nasa.gov. (Scheduled launch: 2004)

GIFTS

http://tellus.ssec.wisc.edu/outreach/gifts/gifts.htm

The Geosynchronous Imaging Fourier Transform Spectrometer (GIFTS) will make revolutionary advances in weather observations and potentially improve weather forecasts—by making vertical and horizontal measurements of winds, water vapor and temperature in the Earth's atmosphere from a geosynchronous orbit.

CONTACT: Arlene Levine, NASA Langley Research Center, Hampton, VA 23681-0001, **Phone:** 757-864-3318, **Email:** a.s.levine@larc.nasa.gov. (Scheduled launch: 2005)

CALIPSO

http://www-calipso.larc.nasa.gov/outreach

The Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellite will produce the first global three-dimensional view of aerosols and clouds. It will improve our understanding of the role aerosols and clouds play in the processes that govern climate responses and feedbacks, and improve the representation of aerosols and clouds in models, leading to more accurate predictions of climate change. Accurate climate model predictions will provide international and national leaders with reliable information to make more informed policy decisions about global climate change. CALIPSO will fly in formation with Cloudsat (see next listing) and other satellites.

CONTACTS: Dianne Robinson, Outreach Director for CALIPSO, Interdisciplinary Science Center (ISC), Hampton University, **Email:** dianne.robinson@hamptonu.edu; Barbara Maggi, Assistant Outreach Director for CALIPSO, Center for Atmospheric Sciences (CAS), Hampton University, **Email:** barbara.maggi@hamptonu.edu. (Scheduled launch: 2005)

CloudSat
http://cloudsat.atmos.colostate.edu/outreach

CloudSat will provide vertical profiling from space of the full range of clouds, from thin cirrus to thick, precipitating convective clouds. It will also provide the first quantitative estimates of ice in clouds. The mission will fill a critical gap in the investigation of feedback mechanisms linking clouds to climate. CloudSat will orbit in formation as part of a constellation of satellites including Aqua, Aura and CALIPSO. One of the unique features that CloudSat brings to this constellation is the ability to fly a precise orbit, enabling the footprint of the CloudSat radar to be overlapped with that of the CALIPSO lidar, as well as with other instruments in the constellation. The precision of this overlap creates a unique multi-satellite observing system for studying atmospheric processes essential to the hydrological cycle.

CONTACT: Debra Krumm, Outreach Coordinator, Department of Atmospheric Science, Colorado State University, Fort Collins, CO 80523-1371, **Phone:** 970-491-8790, **Email:** dkrumm@atmos.colostate.edu. (Scheduled launch: 2005)

NASA Explorer Schools
http://explorerschools.nasa.gov

NASA's challenging and exciting missions provide unique opportunities for engaging and educating the nation's youth. Each year, the NASA Explorer Schools (NES) program establishes a three-year partnership between NASA and 50 school teams consisting of teachers and education administrators. The program focuses on underserved populations in diverse geographic locations from across the country.

While partnered with NASA, NES teams acquire and use new teaching resources and technology tools for students in grades 4–9. Schools in the program are eligible to receive funding (pending budget approval) over the three-year period to purchase technology tools that support science and mathematics instruction.

The NES program provides:

- Customized professional development for teachers and administrators;
- Authentic NASA science and technology investigations for students; and
- Special events opportunities for families.

A competitive application and selection process for NES teams occurs each spring. See Web site for program and application details.

CONTACT: Peggy Steffen, **Email:** psteffen@nasa.gov.

NASA GISS Institute on Climate and Planets (ICP)
http://icp.giss.nasa.gov

ICP is a research, science education and minority outreach program at NASA's Goddard institute for Space Studies (GISS). ICP engages students in grades 9–16 and teachers of grades 7–12 in Earth science research alongside world-class scientists. ICP is the GISS response to a national, state and local movement for scientific institutions to share in the responsibility of providing young people with the highest quality science, mathematics and technical education. Its overall goal is to increase the pool of interested and academically qualified underrepresented minorities in the pipeline who are successfully completing high school science programs and baccalaureate programs in science, engineering and mathematics.

Through direct research experiences focusing on Earth's climate, ICP seeks to help students develop:

- Views of a world connected regionally and globally;
- Problem-solving skills; and
- Knowledge about the Earth system as it relates to science, technology and society.

Students and educators work on-site or remotely with scientists to create new knowledge that may help us better understand and predict Earth's climate. After-school research internships are available at GISS and cooperating universities. During school, ICP faculty members involve students in new or enhanced curriculum to develop climate change science literacy. Full-time summer enrichment programs offer a more intensive research experience. In-service and pre-service teacher workshops are also conducted to share curriculum. Several ICP spin-off program are also available as a result of faculty-scientist collaborations.

CONTACT: Carolyn Harris, ICP Director, GISS at Columbia University, 2880 Broadway at 112th St., New York, NY 10025, **Phone:** 212-678-5653, **Fax:** 212-678-5552, **Email:** charris@giss.nasa.gov.

NASA Satellites Study Earth's Atmosphere: CALIPSO, CloudSat and Aura Working with the GLOBE Project

http://137.198.62.160:8080/co2004.html

CALIPSO, CloudSat and Aura are three satellite-based research missions that will provide students worldwide with a link to NASA research through education and outreach programs. Each of these satellites is scheduled to be included in a formation of six satellites known as the Afternoon Satellite Constellation, also known as the "A-Train." The satellites composing the A-Train will fly in close proximity, providing combined, detailed observations about the condition of Earth and assisting scientists with making predictions related to climate change.

An educator workshop titled "NASA Satellites Study Earth's Atmosphere: CALIPSO, CloudSat and Aura working with the GLOBE Project" is scheduled for July 12–22, 2004, in Fort Collins, Colorado. This workshop primarily targets middle school educators who will work with these three missions to involve students in reporting visual cloud observations and Sun photometer data collection through the GLOBE project Web site. Accepted participants will receive both a stipend and travel expenses. Support will be provided to participants to develop and present at regional workshops within their local school systems. Applications are due February 15, 2004, and are available online.

CONTACTS: CALIPSO: Barbara Maggi, Hampton University, **Email:** barbara.maggi@hamptonu.edu, **Web:** http://www-calipso.larc.nasa.gov/outreach; CloudSat: Sue Lini, Colorado State University, **Email:** lini@atmos.colostate.edu, **Web:** http://cloudsat.atmos.colostate.edu/outreach.html; Aura: Stephanie Stockman, NASA Goddard Space Flight Center, **Email:** stockman@core2.gsfc.nasa.gov, **Web:** http://aura.gsfc.nasa.gov/outreach.

NASA Student Involvement Program (NSIP)

http://education.nasa.gov/nsip

NSIP is NASA's national program of annual science competitions for K–12 students. Competitions include the Aerospace Technology Engineering Challenge; Design a Mission to Mars…and Beyond; My Planet, Earth; Science and Technology Journalism; Space Flight Opportunities; and Watching Earth Change. NSIP links students directly with NASA's diverse and exciting missions of research, exploration and discovery. The competitions foster student literacy in science, mathematics, engineering, technology and geography. Teachers use NSIP to support curriculum goals, spark student interest, encourage creative thinking across disciplines and involve students in science process skills.

Competition entries are due each January. All qualified entrants receive NASA certificates of participation. For each competition, a winner is selected for each NASA Center. Prizes include medals, plaques, NASA presentations at schools, Space Camp scholarships, trips to the National Symposium and/or Student Flight Week and experiments launched aboard the Space Shuttle or a NASA rocket. The Institute for Global Environmental Strategies awards the (independent) $4,000 Thacher Scholarship to a first-place, high-school winner in the Watching Earth Change competition. Entry packets, resource guides for each competition and additional program information are available on the Internet at *http://education.nasa.gov/nsip,* by phone or by email.

CONTACT: Phone: 1-800-848-8429, **Email**: info@nsip.net.

National Space Grant College and Fellowship Program (NSGCFP)

http://www.hq.nasa.gov/spacegrant

NSGCFP funds support graduate and undergraduate students throughout the continental United States and Puerto Rico. The criteria for recruitment and selection are determined by the Space Grant consortia. However, all must be U.S. citizens and enrolled in a full-time degree program related to aerospace, which includes aeronautics, Earth and space science, space engineering and related fields. Designated Space Grant institutions provide specialized training and education programs to help maintain the nation's capabilities in aerospace science, technology and education and to capitalize on the multiple opportunities afforded by the space environment.

Each state consortium is challenged to:

- Establish a national network of universities with interests and capabilities in aeronautics, space and related fields;
- Encourage cooperative programs among universities, aerospace industry and federal, state and local governments;
- Encourage interdisciplinary training, research and public service programs related to aerospace;
- Recruit and train professionals—especially women, underrepresented populations and persons with disabilities—for careers in aerospace science and technology; and
- Promote a strong science, mathematics and technology education base from elementary through secondary school levels.

CONTACT: See Web site to connect to the NASA Space Grant institution in your state.

Near Earth Achievable Remote Sensing (NEARS)

http://wwwedu.ssc.nasa.gov/erc/nears.htm

Through educator workshops provided by the NASA Educator Resource Center at NASA's Stennis Space Center, NEARS introduces teachers to a low-cost method of capturing and using aerial images. The workshops show teachers how to build camera platforms using inexpensive foam and disposable cameras, and how to loft the platforms using kites or helium-filled balloons. Teachers also receive a set of hands-on activities designed to engage students in learning the fundamentals of remote sensing.

CONTACT: Stennis Space Center Educator Resource Center, **Phone:** 1-800-237-1821 (select option 2).

Odyssey of the Mind

http://www.odysseyofthemind.com
http://earthobservatory.nasa.gov/odysseyofthemind

NASA is partnering with Odyssey of the Mind to develop and sponsor a long-term Earth science problem for their annual competition. Founded in 1978, Odyssey of the Mind, an international creative problem-solving program for students from kindergarten through college, attracts students from across the United States and more than 30 other countries. Odyssey of the Mind competitions involve creative exercises in which teamwork, cooperation and ingenuity are applied to complete various tasks. Students choose from one of six long-term "problems" and form teams to develop solutions. The problems range in nature from the technical to the artistic, and solutions are judged for creativity, originality and other criteria. In the spring, teams take their solutions to official competitions at the regional, state, country and world level.

The NASA-sponsored problem for the 2003–04 competition is "Strategy Sphere," which requires teams to design and build two devices that will mechanically propel balls through a circular hoop. Teams will also create a device to retrieve the balls after they are launched. All aspects of the problem solution will be integrated into a theme about how a change in the Earth's geosphere affects the Earth's atmosphere.

CONTACT: For more information, visit the main Odyssey of the Mind Web site or NASA's Odyssey of the Mind Web site.

PIPELINES

http://www.phys.subr.edu/pipelines

PIPELINES, the Program to Increase the Pursuit of Education and Learning In Engineering and Science, is a partnership between Southern University and A&M College in Baton Rouge (SUBR) and Iowa State University (ISU). The program supports activities in Earth and environmental science for K–12 students and teachers, undergraduates, graduates and university faculty. Major components of the program include:

- **Educational reform workshops—**Both SUBR and ISU offer in-service workshops for pre-college teachers and college faculty designed to promote and support standards-based education, with an emphasis on science and mathematics in general and Earth and environmental science in particular. In addition, the SUBR College of Education's Curriculum Center holds regular workshops to aid teachers in preparing meaningful lessons and activities for students, and serves as a statewide repository for instructional materials and supplies for teachers in science and mathematics.
- **GLOBE certification training—**GLOBE is a worldwide network of K–12 students who, under the guidance of trained teachers, make a core set of environmental observations and report their data via the Internet. SUBR provides training for teachers in the basic GLOBE protocols for collecting data. Participating teachers receive GLOBE materials and supplies, as well as stipends for attending after-school, weekend or holiday sessions.
- **Undergraduate research support—**PIPELINES sponsors 20 high-achieving undergraduate students in science, mathematics and engineering to conduct Earth science research at NASA Centers, SUBR or ISU.
- **Earth Science at the Timbuktu Academy (ESTA)—**ESTA is a six-week residential program at SUBR's Timbuktu Academy designed to enhance the academic achievements of pre-college students, including the improvement of SAT/ACT scores. Students are exposed to Earth science education, research and career opportunities. College matriculation in Earth science-related fields is a major objective.
- **Science Bound—**The goal of this ISU program is to increase the number of underrepresented students who enter science and technology careers by shaping their academic preparedness, self-confidence and overall attitudes.

CONTACTS: Diola Bagayoko, Program Director, **Phone:** 225-771-2730, **Fax:** 225-771-4341, **Email:** bagayoko@aol.com; Monika Wright, Assistant to the Director, **Phone:** 225-771-2730, **Fax:** 225-771-4341, **Email:** mwright773@aol.com.

Practical Uses of Math And Science (PUMAS)

http://pumas.jpl.nasa.gov

PUMAS is an online journal of brief examples illustrating how math and science concepts taught in the K–12 classroom are used in everyday life. PUMAS offers a way for researchers to make a substantial contribution to education with a relatively small investment of time and effort. Examples may be activities, anecdotes, descriptions of "neat ideas," formal exercises, puzzles or demonstrations, written primarily by scientists in any style that serves the material well. They are intended mainly to help teachers enrich their presentation of science and math in the classroom.

The examples are available to everyone via the PUMAS Web site. The collection can be searched based on curriculum topic, grade level or subject. All examples are peer-reviewed by at least one scientist with a relevant background and at least one teacher at an appropriate grade level. Once accepted, an example is a citable reference in a refereed science education journal and may be listed in the author's resume. PUMAS is always looking for new contributions and reviewers.

CONTACT: Ralph Kahn, Editor, Jet Propulsion Laboratory, 4800 Oak Grove Dr., MS 169-237, Pasadena, CA 91109, **Phone:** 818-354-9024, *Fax:* 818-393-4619, **Email:** ralph.kahn@jpl.nasa.gov.

Project 3D-VIEW

http://www.3dview.org

Project 3D-VIEW (Virtual Interactive Environmental Worlds) is a Web- and curriculum-based classroom program for upper elementary and middle schools. The program combines NASA data and three types of 3D learning technologies in a curricular materials package for student explorers using 3D viewers and the Internet. Designed primarily for grades 5 and 6, Project 3D-VIEW will create a virtual "tele-presence" for students in each of the Earth's spheres—biosphere, geosphere, hydrosphere, atmosphere and cryosphere. Additionally, a module introducing Earth systems will be available for older or more experienced students.

A major goal of the project is to prepare students for Earth system science courses in high school and beyond by making them experts in each sphere. Using simple Web interfaces, students will explore, create, manipulate and navigate 3D VRML (Virtual Reality Modeling Language) views. The three basic components of the Project 3D-VIEW classroom program are:

- Hands-on activities and content instruction;
- Image visualization and interpretation and manipulation of Earth and digital elevation data for combined spheres; and
- Real-world explorations (local and broad-based) and scenarios that are coupled with student research and analysis and scientist feedback.

An on-site/online teacher professional development program will certify over 1,200 teachers. Partners include four large urban school districts serving underrepresented student populations and Stanford University. Classroom strategies and assessment will be implemented for mathematics and science. Curricular activities developed will meet national standards in science, geography, mathematics and technology. Interested schools should inquire about participating in the beta programming.

CONTACT: Glen Schuster, Director, U.S. Satellite Laboratory, 505 White Plains Rd., Tarrytown, NY 10591, **Phone:** 914-332-8566, **Email:** gschuster@signalsofspring.net.

Project ESCAPE

Project ESCAPE (Eager Student Community Activism for Planet Earth) is an interdisciplinary program for pre-college students focusing on Earth science and using satellite imagery as a learning resource. Additionally, Project ESCAPE provides courses on college readiness and career awareness in the field of Earth sciences.

The program supports the NASA mission of preparing underrepresented students for mathematics, science and technology courses and for careers in these areas. The program goals are to:

- Demonstrate the relevance of Earth science subject matter to the lives of students;
- Actively engage students and present science as a process;
- Give students an understanding of remote-sensing technology;
- Empower students with the skills and knowledge to study the environment in their own communities; and
- Provide students with experience in using computers as learning tools.

Students are exposed to an Earth science curriculum supported by NASA materials and are provided opportunities to attend educational and scientific field trips, such as the Smithsonian's Air and Space Museum, an overnight camping experience, the Naval Research Lab, the Discovery Channel and the Foundation Chesapeake Bay.

Contact: Elaine Bourne Heath, Dean, Faculty and Academic Affairs, Southeastern University, 501 I St., SW, Washington, DC 20024, **Phone:** 202-478-8264, **Fax:** 202-484-8337; **Email:** eheath@admin.seu.edu.

Sensing Cape Cod

http://www.nps.gov/caco/resources/CACO_LC/outreach.htm

Sensing Cape Cod is a pilot project in which NASA Earth science data and remote-sensing technology are used to teach environmental and Earth sciences in concert with the ongoing educational and research efforts in a national park. Science teachers are teaming with Cape Cod National Seashore researchers to develop a middle and high school level coastal ecosystem curriculum unit to monitor local ecological change.

Connections between the responses of local coastal ecosystems to environmental processes and human activities will be made so that teachers and students will have a greater understanding of Earth system science and how climate change is affecting Cape Cod. Project partners include NASA, the National Park Service and the U.S. Geological Survey. Project goals are to:

- Inspire and educate the next generation by providing students with effective and exciting learning opportunities about the application of NASA research and technology at national parks;
- Enable and encourage teachers to use NASA science, technology and educational tools in a national park context; and
- Create a venue for educators, students and scientists to use national parks as laboratories for scientific research and learning.

CONTACTS: Anita Davis, NASA Goddard Space Flight Center, Code 923, Greenbelt, MD 20771, **Email:** adavis@pop900.gsfc.nasa.gov; Nancy Finley, Chief of Natural Resources, Cape Cod National Seashore, 99 Marconi Site Rd., Wellfleet, MA 02667, **Phone:** 508-349-3785, ext. 216, **Fax:** 508-349-9052, **Email:** nancy_finley@nps.gov.

Students' Cloud Observations On-Line (S'COOL)

http://scool.larc.nasa.gov

S'COOL is a component of NASA's Clouds and the Earth's Radiant Energy System (CERES) project. CERES is an instrument onboard several NASA satellites that measures the amount of energy reflected and emitted by clouds. S'COOL participants make "ground-truth" measurements—land-based observations that are used to validate and improve satellite measurements.

Participating students are asked to make basic weather observations and to record the type and features of clouds in the sky at the time the satellite is scheduled to pass over their location. The data is then submitted online or sent by email, fax or regular mail to NASA for entry into an online database. Students can access their results as well as those from other participating schools using the S'COOL Web site. Satellite observations for matching times are also posted so that students can compare their observations to the those of the satellite, and NASA scientists can evaluate the performance of the CERES instrument.

Participants receive instructional materials, a schedule of satellite overpass times and information necessary for reporting results. There is no cost to participate. A week-long workshop is held each summer at NASA's Langley Research Center, allowing participating teachers to obtain an in-depth understanding of related scientific issues. See Web site for registration information.

CONTACT: Attn: S'COOL, Mail Stop 420, NASA Langley Research Center, Hampton, Virginia 23681-2199, **Phone:** 757-864-5682, **Fax:** 757-864-7996, **Email:** scool@larc.nasa.gov.

Summer High School Apprenticeship Research Program (SHARP)

http://www.mtsibase.com/sharp

NASA SHARP is designed for students who have demonstrated a strong interest in and aptitude for science, technology, engineering, mathematics and geography (STEM+G). One of the program's objectives is to encourage the career paths of pre-college students who have been traditionally underrepresented in STEM+G fields—females, African Americans, Native Americans, Hispanics, Pacific Islanders (natives of the Philippines, Guam, American Samoa and Micronesia) and the disabled. The NASA SHARP "Commuter Component" is conducted at 13 participating NASA field centers, while the "Residential Component" is conducted at universities throughout the United States.

Each year, approximately 400 students are selected to participate in NASA SHARP for a minimum of eight weeks during the summer. Some of NASA's top science professionals, while conducting cutting-edge research as well as working on state-of-the-art equipment, mentor qualified students. One of NASA's primary goals is to strengthen the agency's and nation's ability to recruit and sustain a more diverse workforce by preparing students for careers in STEM+G fields.

CONTACT: For more information on the Commuter Component of NASA SHARP, please write to the NASA field center of interest (a list is provided on the SHARP Web site). For more information on the Residential Component, or for information about NASA SHARP at the national level, please contact the program manager at: Modern Technology Systems, Inc. (MTSI), 6801 Kenilworth Ave., Suite 200, Riverdale, MD 20737-1331, **Phone:** 301-985-5171, **Fax:** 301-985-5176, **Email:** info@nasasharp.com.

Tropical Center for Earth and Space Studies (TCESS)

http://tcess.uprm.edu

The TCESS at the University of Puerto Rico at Mayagüez (UPRM) is a NASA University Research Center—a multidisciplinary research unit established at a minority institution to focus on a specific area of NASA interest. The center's education component, GLOBE TEST, is a comprehensive project to align science, environmental education and technology with current state educational reforms. The initiative integrates calculator-based laboratory (CBL) technology, geographic information systems (GIS) techniques and GLOBE protocols to current laboratory and curriculum in chemistry, biology and mathematics.

The overall goal of GLOBE TEST is to transform a significant number of in-service and pre-service teachers into proficient educators in the areas of science and technology. The project's professional development program combines workshops, Saturday academies, follow-up activities and visits to schools, as well as activities for teacher, parent and student involvement. The intensive week-long workshops and Saturday academies allow teachers to become skilled in GLOBE TEST activities through hands-on experience, while follow-up activities bring teachers and their students to UPRM's facilities to integrate GLOBE TEST activities with the K–12 science curriculum.

CONTACT: Miguel Velez-Reyes, Director, Tropical Center for Earth and Space Studies (TCESS), University of Puerto Rico, PO Box 9048, Mayagüez PR 00681, **Phone:** 787-832-2825, **Fax:** 787-832-2485; **Email:** m.velez@ieee.org.

Virginia Geospatial Extension Program

http://www.cnr.vt.edu/gep

The Virginia Geospatial Extension Program conducts targeted programs that promote the appropriate use of geospatial tools and applications, and integrate geospatial concepts throughout the K–20 educational pipeline. These tools and applications benefit our lives in many ways and include the global positioning system (GPS), geographic information systems (GIS) and using remote-sensing data sources—satellite imagery and aerial photography—to provide innovative perspectives on local, regional, state and national issues. For example, GIS is to support urban planning, homeland security and to facilitate the management of environmental resources, including forests, wetlands, coastlands and endangered species.

The program is providing K–12 educational outreach in collaboration with the Virginia Space Grant Consortium's OVERspace program, specialized workforce courses and training through Virginia's Community College System and other VSGC member universities, faculty development, and linkages to NASA and other geospatial resources, data and programs. A key component of this program is its participation with Virginia extension agents, through Agriculture and Natural Resource programs and 4-H Youth Educational initiatives, to support the dissemination of information, training and application development at the grassroots level.

The program is sponsored by the VSGC and the Virginia Cooperative Extension, and is co-located at Virginia Tech in the College of Natural Resources and the College of Agriculture/Virginia Cooperative Extension.

CONTACT: John McGee, Geospatial Extension Specialist, 219 Cheatham Hall (0324), Virginia Tech, Blacksburg, VA, 24061, *Phone:* 540-231-2428, *Email:* jmcg@vt.edu.

Visiting Student Enrichment Program (VSEP)

http://gest.umbc.edu/student_opp/2004_vsep.html

VSEP offers students from the high school to graduate level summer internships with the Goddard Earth Sciences and Technology Center (GEST), working with scientists at NASA's Goddard Space Flight Center (GSFC). Students interact with scientists and professionals at a world-class facility, while gaining valuable experience through a project focused primarily on computer science or the application of computers to solve problems in other sciences. VSEP also holds field trips and lectures to broaden appreciation for GSFC's mission and activities. Past student projects have included simulating neural networks, preparing image

analysis algorithms on supercomputers, developing computational science applications, and creating interactive Web sites.

GSFC facilities that offer the internships include:

- **The Scientific Computing Facility,** with its advanced computers (i.e., Cray T3E, Cray SV1's, SGI ORIGIN 2K and ORIGIN 3K, SUN E10000 and E6500, IBM RS 6000 SP), the world's largest UniTree mass storage system, as well as a visualization studio.
- **The National Space Science Data Center,** a central repository for the large databases generated from NASA spacecraft.
- **The Data Systems Technology Division,** which provides a full spectrum of hardware and software environments to support applied research and development of advanced solutions to operational problems.
- **Laboratory for Atmospheres,** which researches areas such as atmosphere modeling and climate analysis in support of Earth observing systems; and
- **Laboratory for Hydrospheric Processes,** which researches the oceanic, cryospheric and hydrologic sciences.

The 2004 VSEP runs from June 7 to August 13 at GSFC in Greenbelt, Maryland. (Subject to housing availability, high school students may need to begin or end later, depending on their academic calendar.) VSEP is open to full-time students in computer science, the physical sciences and mathematics. Participants must be either U.S. citizens or foreign nationals in U.S. schools who are either permanent residents or who possess a valid F-1 or J-1 visa. All selected students will be subject to a pre-employment security background check under current security guidelines. Online applications and instructions can be found at the Web site.

CONTACT: Visiting Student Enrichment Program, Code 900.1, NASA Goddard Space Flight Center, Greenbelt, MD 20771, **Email:** vsep@gsfc.nasa.gov.

You Be the Scientist with Satellite Imagery in EZ/EC Communities (YBTS)

http://nia.ecsu.edu/nrts/ess/ezec/ezec.html

YBTS is a student enrichment project for six selected middle schools located in the economic empowerment zone/enterprise communities of Portsmouth, Virginia and Halifax, North Carolina. The project is designed to support extra-curricular science activities that will increase awareness and use of GOES weather satellite data. YBTS is helping students meet core Earth science learning objectives and to develop marketable skills in the area of computer technology, while exposing them to a variety of careers available in research, data analysis, applications and computer visualization. The project is conducted through the Minority University-Space Interdisciplinary Network's Network Resources and Training Site at Elizabeth City State University.

CONTACT: Linda Hayden, NASA Network Resources and Training Site, Elizabeth City State University, Box 672, 1704 Weeksville Rd., Elizabeth City, NC 27909, **Phone:** 252-335-3696, *Fax:* 252-335-3790, **Email:** lhayden@umfort.cs.ecsu.edu.